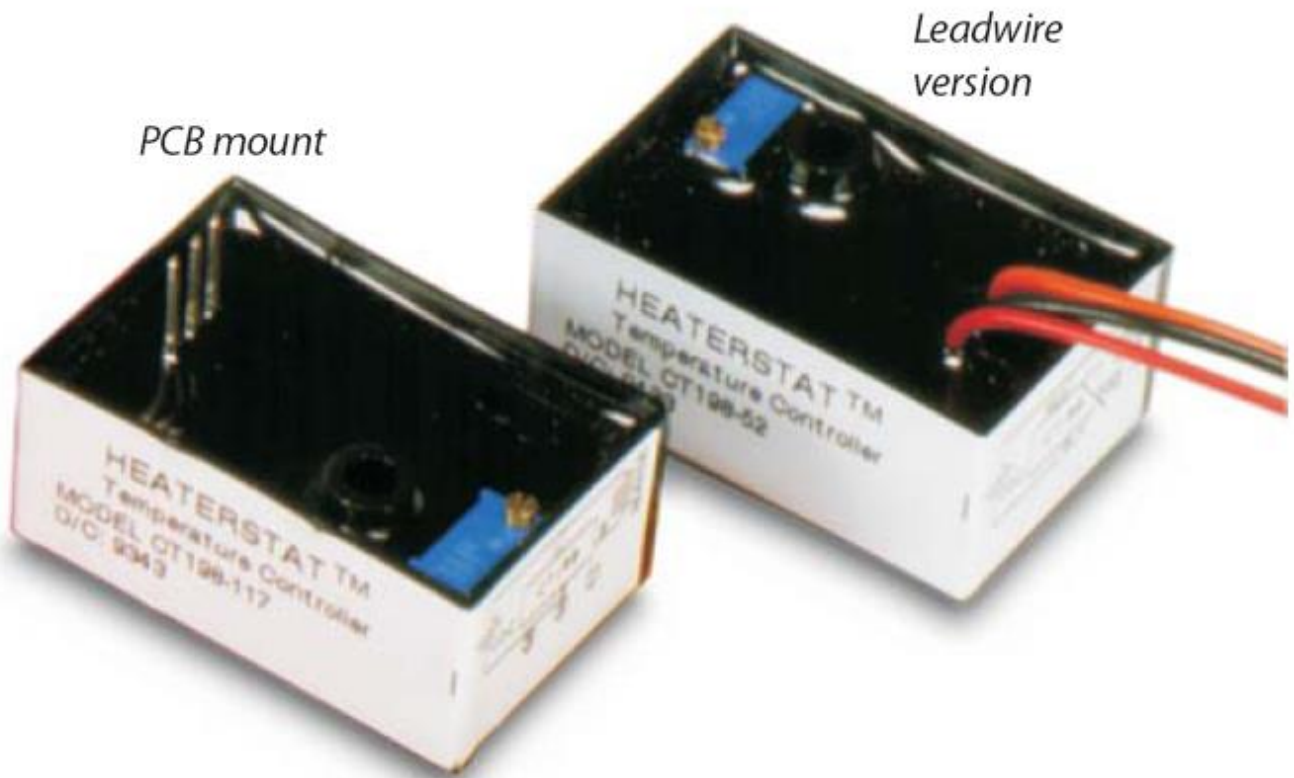




## CT198-111A Heaterstat Installation and Operating Instructions



## Description

The CT198 Heaterstat is a sensorless DC temperature controller. It uses a high TCR (Temperature Coefficient of Resistance) heater to sense and control heat output - no separate sensor or thermostat required. The CT198 is more durable than a mechanical thermostat due to the solid state electronics, and has an adjustable setpoint which allows you to fine tune the control temperature for your application. All that is required for temperature control is a DC power source, a CT198 Heaterstat, and a matching heater.

## Specifications

<b>Setpoint:</b>	116 to 185 Ω
<b>CT198 standard calibration:</b>	Standard Setpoint <sup>1</sup> : 147.2 Ω Calibration accuracy: ±0.2%
<b>CT698 calibrated matched sets<sup>2</sup> (heater &amp; controller):</b>	System accuracy: ±1.0°C (1.8°F) max.
<b>Hysteresis:</b>	0.05% max.
<b>Maximum Setpoint drift due to:</b>	Self-heating: ±0.2% Ambient temperature: ±0.02 %/°C Supply voltage: ±0.03%/volt
<b>Ambient:</b>	Operating temperature: -40 to 70°C (-40 to 158°F) Storage temperature: -55 to 85°C (-67 to 185°F) Relative humidity: 90% max. continuous
<b>Power supply:</b>	Supply voltage range: 7.5 to 60 VDC 24 VDC nominal
<b>Controller supply current:</b>	Output ON: 3mA max. Output OFF: 2mA max. (< 1mA typ. @ 10 VDC)
<b>Output:</b>	Maximum continuous current: 0.16 Amps Maximum current for 1 minute: 0.5 Amps Minimum current for proper sensing: 0.5 Amps Maximum output ON resistance: 2.3 Ω Minimum output OFF resistance: 50 K Ω
<b>Scan rate (heater temperature above Setpoint):</b>	Approximately 10 second
<b>Scan pulse width:</b>	10 millisecond max.
<b>Supply voltage ripple effects:</b>	Negligible, assuming 50/60 Hz, 10 % max. ripple
<b>Physical:</b>	ABS case, epoxy sealed for moisture resistance
<b>Case Dimensions:</b>	1.0 x 1.5 x 0.69"
<b>Connections:</b>	6 inch long AWG #22 wires
<b>Weight:</b>	1 ounce (30 g)
<b>Mounting:</b>	Mounting hole for #6 screw through, or #8 thread forming screw.

<sup>1</sup> Unless specified otherwise in the part number.

<sup>2</sup> Specify Model CT698 for match calibrated sets. The setpoint temperature is coded into the part number.

## Operation

The diagram below shows how the Heaterstat works. It periodically powers the heater just long enough to check resistance. If heater temperature is above setpoint (left side of graph), power shuts off within 0.010 seconds. If heater temperature is below setpoint, the Heaterstat leaves power on and continually reads resistance until element temperature reaches setpoint. It then shuts off and waits until time for the next pulse. Scan rate, the off-time between pulses, is factory set from 0.1 to 10 seconds (1 second is standard). Faster scans provide tighter control while slower scans conserve power during idle times (a 0.010 second pulse every 10 seconds takes only 0.1% of full-on power).

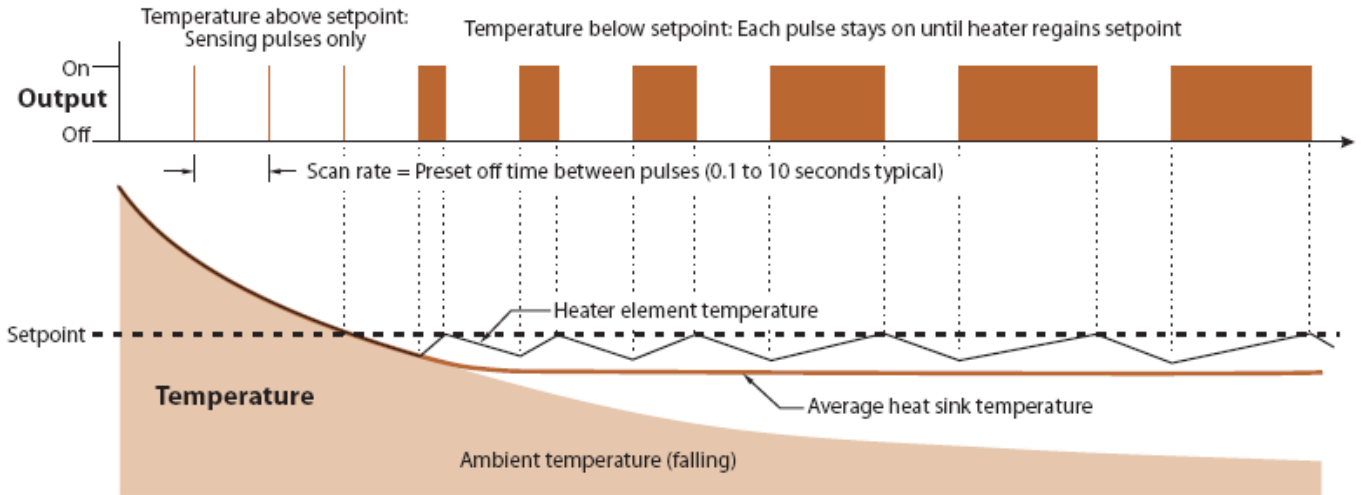


Figure 1

## Installation

The CT198 is small enough to mount directly to printed circuit boards, and will withstand ordinary wave soldering and water washing. Test before washing with other chemicals.

If you intend to adjust the setpoint after installation you will need a hole in the board opposite the setpoint trimmer. Refer to the data sheet for recommended PCB layout. Secure the CT198 to the board through the mounting hole.

Several manufacturers (e.g. AMP and MOLEX) make a variety of .100" spaced connectors which mate with the controller's pins. Contact these or one of many other manufacturers for details.

The leadwire version of the CT198 does not require a circuit board. Install it using a #8 thread forming screw or a #6 screw through.

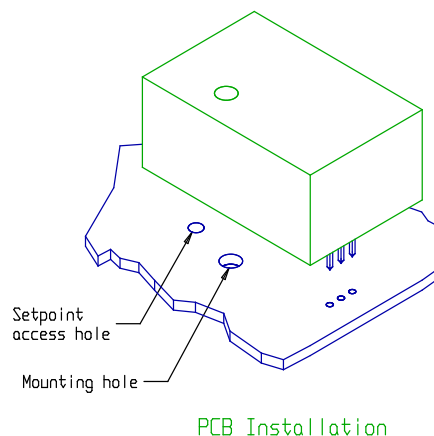


Figure 2

## Heater Mounting

Evaluation kits #1 and #2 are supplied with #10 pressure sensitive adhesive for easy installation. #10 PSA is suitable for flat or slightly curved surfaces and has a temperature limit of 100°C. To use PSA:

1. Remove the white (unmarked) backing paper. Be careful not to touch the adhesive.
2. Press the flat side of the heater onto the adhesive and rub it down.
3. Trim the excess adhesive.
4. Remove any dirt or oil from the mounting surface.
5. Carefully lift the marked backing paper and peel it away, leaving the adhesive on the heater.
6. Press the heater onto the mounting surface and rub it to remove any entrapped air.

Heater Design Guide HDGo1 and Application Aid #22 describe the complete range of options for heater mounting. Refer to them for custom designed heaters. For the best performance, always design for maximum contact between the heater and heat sink.

## Heaterstat Calibration

The CT198 has a single trimmer for temperature setpoint, factory calibrated to the resistance of your heater at the desired control temperature. Depending upon your application, you may not have to change the setpoint.

The accuracy of the setpoint, as received from the factory, depends to a large degree on the resistance tolerance of the heater. A typical allowance is 10% for an etched-foil heater, 2% for wire. Tighter tolerances will improve accuracy and interchangeability but at increased cost. When close calibration is essential, Minco can calibrate heaters and controllers in matched sets. In this case, it is important to connect the heater leads directly to the CT198 leads or pins or as close as practical. This will minimize errors due to extension leadwire or circuit traces.

The best calibration method is with the heater installed in the system as it will actually be used. Then, using a separate temperature meter and sensor in contact with the heat sink or heater, adjust the setpoint until the proper control temperature is achieved. This will compensate for typical thermal gradients, heater tolerances, and any circuit traces or extension leadwire to the heater. Since the setpoint is adjustable,  $\pm 20\%$ , most errors can be calibrated out.

Alternatively, the heater may be placed in a temperature controlled bath (note that most standard heaters are not suitable for direct immersion in water). Use an ammeter as shown in Figure 4, and adjust the setpoint to the point where the heat just begins to cycle on and off.

A third method for calibration is to simulate the heater's resistance at setpoint with a decade box or fixed resistor. This method may be difficult because of the precision resistance required while also dissipating power. Care must be taken to prevent the heat from shifting the resistance value.

Be sure to thoroughly test your prototype system under all operating conditions.

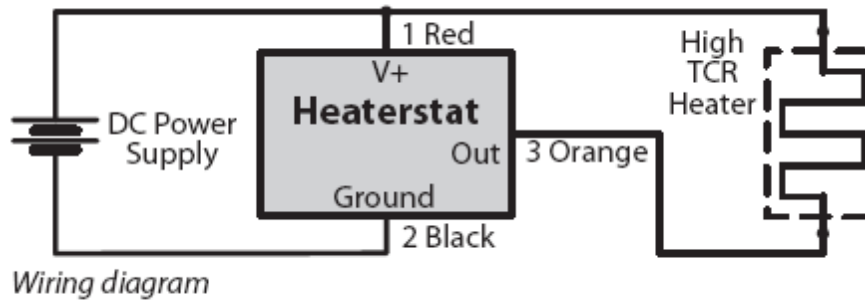


Figure 3

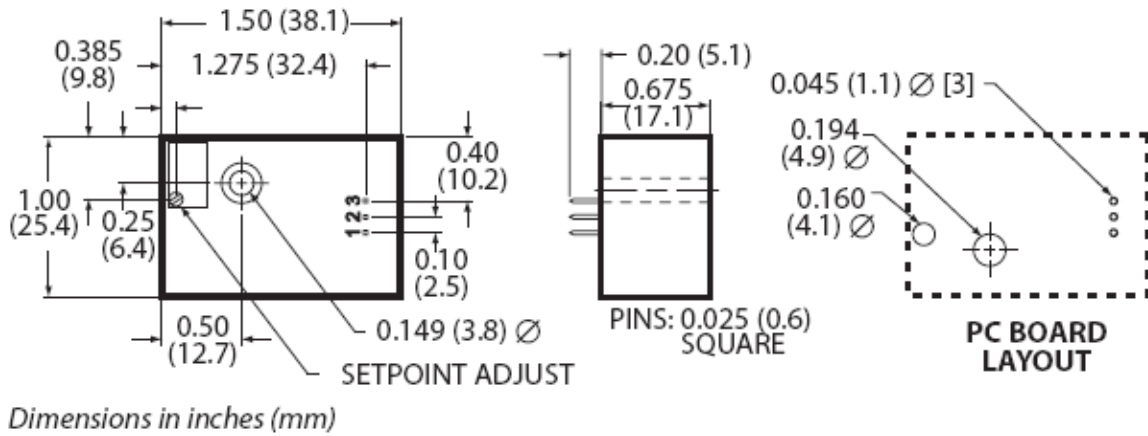
## How to Order Standard Models

CT198-1019	<b>Model number</b> CT198 = Heaterstat (nominal setpoint) CT698 = Heaterstat matched to heater
R	<b>Setpoint calibration code</b> R = Nominal heater resistance (CT198) T = Heaterstat/heater matched set (CT698)
365	<b>Initial calibration setpoint</b> Setpoint calibration code = R: Nominal heater resistance at set point temperature (in ohms).* Must be within allowable range for specified model. Setpoint calibration code = T: Temperature setpoint. Specify temperature and scale (°C or °F) Ex: 120F represents 120°F
L	<b>Leads</b> L = Leadwires (standard) P = Pins (LED not available)
1	<b>Scan rate</b> 0.1 to 10 seconds (1 second standard)
<b>CT198-1019R365L1 = Sample part number</b>	

\* To determine heater resistance at temperature T, go to [www.minco.com/ct198.html](http://www.minco.com/ct198.html)

Resistance versus temperature tables are available at: [www.minco.com/sensorcalc/](http://www.minco.com/sensorcalc/)

## Dimensions



## Warranty

Items returned within one year from the date of sale, transportation prepaid, which Minco Products, Inc. (the "seller") reasonably determines to be faulty by reason of defective materials or faulty workmanship will be replaced or repaired at the seller's discretion, free of charge.

This remedy is to be the sole and exclusive remedy available to the buyer in the event of a breach by the seller. Items that show evidence of mishandling or misapplication may be returned by the seller at the customer's expense.

Furthermore, the seller is not to be held responsible for consequential damages caused by this product except as required under Minnesota Statutes, Section 336.1-719 (3).

This warranty is in lieu of any other expressed warranty or implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability of the seller or its employees or agent.

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**Worldwide Headquarters**  
7300 Commerce Lane  
Minneapolis, MN 55432 USA  
Tel: 1.763.571.3121  
Fax: 1.763.571.0927  
sales@minco.com  
www.minco.com

**European Headquarters**  
Usine et Service  
Commercial, Z.I.  
09310 Aston, France  
Tel: (33) 5 61 03 24 01  
Fax: (33) 5 61 03 24 09

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